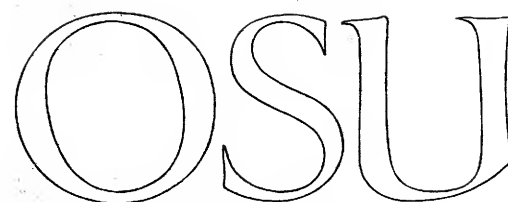


COSY for OS-3

Revised: November, 1972



COMPUTER CENTER

Oregon State University
Corvallis, Oregon 97331

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INTRODUCTION

The OS-3 COSY (COmpressed SYmbolic) processor is a mechanism for maintaining card decks* in a compact form. As directed by COSY control cards, it accepts as input COSY decks or files of Hollerith records, provides updating procedures, and produces as output an assortment of listings, COSY decks, and Hollerith records. COSY may be used to process any source language which does not contain COSY control card statements (but see page 5).

COSY decks are greatly compressed versions of the equivalent Hollerith decks. The compression is achieved in several ways. First, COSY decks are binary decks so that two characters are punched into each data column of a card. Secondly, special symbols are used in place of multiple blanks. In addition, a special end-of-record character is used--trailing blanks can be disregarded. Lastly, the resulting compressed card images are packed continuously so that the compressed versions of many Hollerith cards are packed onto one COSY card. A COSY deck is generally one-half to one-fifth as large as the Hollerith original. Occasionally the compression ratio is even better.

The reduction in size is a particular advantage with respect to the physical handling of large source decks. Furthermore, COSY decks facilitate the controlled revision of large source decks. The original deck need not be changed until all revisions have been debugged. Because the revision cards are kept separate from the intact source deck, there is never any doubt which is the original and which are the changes.

A COSY library is a set of COSY decks stored on tape or disk file, each separated by an end-of-file (EOF). The library itself is

* The phraseology in this manual is in terms of punched cards, the usual COSY input and output medium. However, Hollerith input and output is not restricted to 80-character records, and COSY card deck images may be stored in files, on magnetic tape or other storage media.

terminated by a double EOF. A COSY library can be selectively updated by a single COSY run and the Hollerith output may be used for subsequent assembly or compilation. A library of Hollerith source decks can also be maintained--the decks are separated by single EOF cards and terminated by a double EOF. Hollerith and COSY input can be from the standard input unit, but the EOF card following the Hollerith or COSY source deck must be omitted in this case; instead, the next COSY control card would signal the end of the source deck.

Input to the COSY processor consists of control cards, revision data, Hollerith decks, and COSY decks. The Hollerith or COSY data can follow DECK/ cards on the standard input unit, or they can be in the form of libraries on tape or in a file.* Changes are made by insertion, deletion, and covering. Depending upon parameters on the COSY/ and DECK/ cards, output can be punched (COSY, Hollerith) or printed (log, listing, revisions).

Individual input records (card images, if you will) from Hollerith or COSY decks are automatically assigned consecutive decimal sequence numbers: 1, 2, 3, These sequence numbers serve to identify uniquely each such record for changes which are to be made. DELETE/, INSERT/, and COVER/ control cards specify such sequence numbers, and they must do so in ascending sequence order.

The OS-3 COSY parameter processor follows rules of usage generally obtained throughout OS-3:

- (a) Where appropriate, the name of an OS-3 saved file may be substituted for a lun (logical unit number).
- (b) Output luns will be equipped by COSY if necessary.
- (c) Output named files will be created if they do not already exist.

* Input files may be COSY-blocked or unblocked--they will be read correctly in either case. Records from CDC MASTER and MSOS operating systems are accepted by OS-3 COSY.

- (d) Input luns must already be equipped.
- (e) Any saved file identified by name, whether for input or output, is rewound before use.
- (f) Luns may be rewound with /R, otherwise they are read or written from their current positions.

In addition, there are available within COSY the usual collection of manipulative commands (rewind, forward-space, etc.). They are analogous to OS-3 control-mode commands. [Exception: DELETE/ has a different function in COSY.]

More than one lun may be specified:

REWIND/ 5,6

This would rewind luns 5 and 6.

Multiplicative factors may be used where appropriate:

FWSP/ 5(4),6

This would forward-space four records on lun 5, one record on lun 6.

Indicative error messages have been added to OS-3 COSY. Errors of input, whether of source data or commands, are the most common. As an aid to identifying such errors, the offending input record is printed as the record immediately after the error message.

All errors prevent the normal completion of the COSY process. Most errors cause processing to terminate immediately, but in a few cases processing of revision cards is allowed to continue in hope that subsequent errors may also be identified.

THE OS-3 COSY CONTROL CARD

#COSY,I=lun,L=lun,T=num,Z,/=char

This control mode instruction causes OS-3 to load and start the COSY processor. By "lun" we mean logical unit number, "num" an integer, and "char" a character. The name of a saved file may be substituted for "lun".

I=lun

The input (of COSY control cards and revision detail cards) to the COSY processor is to come from the specified logical unit. If no lun is specified or if this parameter is omitted, then lun 60 is assumed. Any name starting with I may be substituted for the I alone. (e.g., INPUT=lun)

L=lun

This causes the log listing (of all COSY control cards and revision detail cards) to be sent to the specified logical unit. If no lun is given, then unit 61 is assumed. If this parameter is omitted entirely, then no log is produced. Any name starting with L may be substituted for the L alone.

T=num

Trim or truncate records from the input unit "I". The given number (default value = 72) specifies the number of columns to be used.

Z

This parameter allows relaxation of input (unit "I") from a terminal. Usually COSY control card identifiers (e.g., DECK/) must start in column 10. With this option enabled, the identifiers may be started after one or more leading

spaces. Deck names, when appropriate, must still start in column 1; they would be followed by at least one blank or space.

/=char

Usually, COSY control card identifiers are terminated with a slash (e.g., INSERT/). This replacement mechanism allows substitution of a different character. For example

/=*

redefines all COSY control card identifiers: DECK*, COSY*, REWIND*, etc.

One can use this slash-replacement capability to manipulate data which contains the usual (slashed) COSY control cards.

Examples:

#COSY,LOG=32,I

Explanations:

Input is assumed to come from lun 60; a log will be produced on lun 32.

#COSY,INP=1,L

Input will come from lun 01; a log will be produced on lun 61.

#COSY

Input is assumed to come from lun 60; there will be no log.

#COSY,Z,L=1/R

Relaxed input will be taken from lun 60; a log will be produced on lun 01, which will be rewound first.

#COSY,I=STUFF,/+=

Input control material is to be found on a saved file named 'STUFF'. COSY will equip a lun of its own choosing and rewind before reading. The identifiers on COSY control cards in 'STUFF' will be terminated with a plus sign instead of the usual slash.

COSY CONTROL CARDS

These are listed below in alphabetical order. They are discussed individually in paragraphs that follow. Unless relaxed input is being taken from a terminal, the operation identifier (e.g., DECK/) starts in column 10. Parameters, if any, start anywhere after the identifier. (However, it is standard practice to start parameters in column 20.) Names for COSY decks are appropriate on indicated control cards. The names may not have more than eight characters and must start in column 1. In general, COSY requires names to start with an alphabetic character or with a * or †.

| | | |
|----------|-----------|--|
| deckname | BCOPY/ | lun,lun |
| | BKSP/ | lun(s) |
| deckname | COPY/ | lun,lun |
| deckname | COSY/ | ed |
| | COVER/ | mm,nn |
| deckname | DECK/ | B=lun,C=lun,H=lun,I=lun,L=lun,R=lun,S=char, V=lun,E=mm,T=mm,D=newname |
| | DEFAULT/ | B=lun,C=lun,H=lun,I=lun,L=lun,R=lun,S=char, V=lun,E=mm,T=mm,D=newname |
| | DELETE/ | mm,nn |
| | ENDCOSY/ | |
| | FWSP/ | lun(s) |
| | INSERT/ | mm |
| deckname | POSITION/ | lun |
| | RELEASE/ | lun(s) |
| | REWIND/ | lun |
| | SEFB/ | lun(s) |
| | SEFF/ | lun(s) |
| | WFM/ | lun(s) |

In the above, 'mm' and 'nn' would be numerical values, and 'char' would be a character. 'lun(s)' indicates one or more logical units, possibly with multiplicative factors.

Names of saved files can be substituted for luns in the DECK/ and DEFAULT/ control cards.

```
deckname  BCOPY/      LUN1,LUN2
deckname  COPY/       LUN1,LUN2
```

These copying commands produce blocked and unblocked Hollerith output, respectively. Unblocked output is in the usual single binary card images, i.e., forty 24-bit words. Blocked output is in 320-word records; it saves space on the output file, particularly on magnetic tape.

Successive COSY decks are copied from logical unit LUN1 to LUN2, beginning at the current positions of both files. Copying from LUN1 continues up to, but not including, the deck specified. But if the deck name is absent, copying continues to the end of the COSY library on LUN1 (i.e., to a double EOF).

```
BKSP/      lun,lun,...
```

This is a request to backspace the one or more logical units. It is analogous to the OS-3 control-mode #BKSP command.

```
Examples:  BKSP/      5
           BKSP/      5,6
           BKSP/      5,6,13(4)
```

```
deckname  COSY/      ed
```

This control card identifies a COSY compressed deck and must always be the first card of such a deck. A two-digit edition number (between 01 and 99) is found in columns 30-31. OS-3 COSY/ deck identifiers have an eight-character date MM/DD/YY in columns 40-47 and a 24-hour time in columns 50-53. These indicate when the deck was created. On the other hand, COSY decks produced by the CDC MASTER operating system do not have the date and time on the COSY/ deck identifier; rather, the character M is in column 40. The OS-3 COSY processor can accept CDC MASTER and MSOS COSY decks as input.

COVER/ mm,nn

'mm' is a card (record) sequence number (see DELETE/ for details). 'nn', if included, specifies a card column. If not included, 'nn' defaults to 40.

This control card allows one to alter the latter part of existing source records, by covering up the right-hand portion with new text provided on accompanying cards. It is particularly well suited to adding comments to existing assembly language coding. A COVER/ card is followed by one or more text cards which supply covering characters for the indicated and subsequent records. The original contents of columns nn through the end-of-record are replaced by what is found from column 1 onward, on the card immediately following the COVER/ card. This applies to source record mm. If a second text card follows, it is applied to source record mm+1 and so forth.

Examples: If record 13 is:

ABCDEF6
then

 COVER/ 13,4
XX

changes it to:
ABCXX

If records 77 and 78 are:

LOC1 UJP,I ZIP
 ENA 16
then

THIS IS A COMMENT.

 COVER/ 77
CHANGE THE COMMENT.
ADD A COMMENT.

changes records 77 and 78 to be:

LOC1 UJP,I ZIP
 ENA 16

CHANGE THE COMMENT.
ADD A COMMENT.

Here the character replacement starts by default in column 40.

deckname DECK/ B=1un,C=1un,H=1un,I=1un,L=1un,R=1un,S=char,
 V=1un,E=mm,T=mm,D=newname

This is a command to process the named deck, with control options as specified. If the deck name is absent, the next COSY deck is processed. Otherwise, the input unit indicated by the I parameter will be searched for the named deck, starting at its present position. If the deck is not found, the file is rewound and searched from the beginning.

As elsewhere, mnemonic parameter strings can be substituted for the single-letter flags, so long as the first letter remains the same (e.g., INPUT=13 in place of I=13). The parameter assignments can be in any order. Parameter assignments may be explicit (e.g., B=43 or B=ANYNAME). However, if the parameter is included but no value is specified (e.g., B), a default value is assigned. If the parameter is absent entirely, it is either given a default value or the option is inhibited.

The default assignments may be changed with a DEFAULT/ control card. Unless so changed, the values are:

| Parameter | If absent (inhibit if missing) | If included but unspecified |
|-----------|-----------------------------------|--------------------------------|
| B | | 50 |
| C | | 62 |
| H | | 50 |
| I | INP | INP |
| L | | LOG |
| R | | LOG |
| V | | 50 |
| S | | * |
| E | Previous +1 | Previous +1 |
| T | TRUN | TRUN |
| D | | error |

'INP' has the same value as the I parameter on the OS-3 #COSY control card (=60 if unspecified).

'LOG' has the same value as the L parameter on the #COSY control card (=61 if unspecified).

'TRUN' has the same value as the T parameter on the OS-3 #COSY control card (=72 if unspecified).

Common-sense rules forbid equating input and output luns and equating luns for certain dissimilar types of output. On the other hand, the luns designated by the L and R DECK/ card parameters may be identical to the COSY 'LOG' unit. Similarly, the #COSY 'INP' parameter may be the same as the 'I' parameter on the DECK/ card. However, the luns designated for the other DECK/ card parameters must be unique. For example, the 'B' and 'H' options, if enabled, may not specify the same lun, nor an input lun, nor a LOG or listing lun.

B Blocked COSY output. This option is intended for COSY deck output to magnetic tape or file on the specified logical unit. The output is blocked into larger records to save space and to reduce tape I/O time. (If this B option is not used, a COSY output record is 40 words, which exactly fills one binary 80-column card. Blocked records, on the other hand, are 320 words long. OS-3 COSY blocked output is readable by MASTER. Conversely, OS-3 COSY will automatically adjust to read such tapes as input.)

C COSY deck output. The resulting updated and resequenced COSY deck will be sent to lun 62 unless another is specified. No new COSY deck is produced if the parameter is missing.

D New deckname. The COSY deck may be renamed with this parameter. It makes sense only if a B or C option is enabled.

E Edition. Edition numbers help distinguish succeeding versions of a given COSY deck. If this parameter is missing or not assigned a value and if corrections are made, the edition number of the new deck will be one greater than that of the old. When an original COSY deck is being created from Hollerith input, 01 will be the default first edition number. Any edition

number between 01 and 99 may be assigned explicitly, whether updating an old COSY deck or starting a new one.

H Hollerith output. The updated Hollerith version of the input deck is sent to this logical unit. (This is usually a line-by-line listing of a program with COSY sequence numbers in columns 76-80. See the L parameter explanation.)

I Input. The desired deck is to be found on this logical unit. It may be a COSY deck or Hollerith text. It may be COSY-blocked or unblocked.

L Listing. This produces Hollerith output (cf. the H parameter explanation) with a blank carriage control word at the beginning of each record.

R Revision listing. This parameter requests a listing of all cards changed in the deck through COVER/, INSERT/, or DELETE/ commands. Each such card image in this listing is tagged appropriately: 'COVERED', 'INSERTED', or 'DELETED'. Furthermore, to each card image is appended an appropriate sequence number. If the B and C parameters are missing so that no resequencing is done to produce a new COSY deck, the sequence numbers from the old COSY deck are redisplayed here. These, of course, correspond directly to the parameters on the DELETE/ control card. If, on the other hand, a B or C parameter is used to produce an updated COSY deck, the old sequence numbers may be less informative. So when a new (resequenced) COSY deck is produced, the deleted cards are listed with the (new) sequence number of the (undeleted) card position they would have, had they not been deleted. This enables one to locate the deleted cards in relation to the new sequencing.

S Save. This option provides for saving, in place, deleted lines (cf. DELETE/) in the Hollerith (H) output. The affected lines are shifted to the right two character positions and are preceded with a pair of the specified character. For some

computer languages that character may be chosen appropriately, so to transform the line into a comment. Thus, S=* for the Assembler; S=C for FORTRAN. If a new COSY deck is being created (cf. C and D options), this S option is suppressed even if specified.

T Trim or truncate. The indicated integer specifies the number of columns of significant information in records from the input unit. $1 \leq T \leq 136$. If $72 \leq T \leq 75$, then card sequence numbers of five decimal digits are placed in columns 76-80 of the Hollerith output.

V Variable length Hollerith records. Output to the specified logical unit will be of variable length. Any sequence numbers in columns 76-80 (cf. T) are suppressed. Trailing blanks are discarded. The resulting records are usually shorter than those resulting from the H option. This option is most often used for Hollerith output to the card punch (see H).

DEFAULT/ B=1un,C=1un,H=1un,I=1un,L=1un,R=1un,S=char,
 V=1un,E=mm,T=mm,D=newname

This control card allows one to change the table of default values for DECK/ control card parameters. In that table, the entries in the "if absent" column may be changed; the "included-but-unspecified" column is constant.

If a parameter is omitted from the DEFAULT/ control card, it is reassigned its pristine value as shown in the original DECK/ default table.

If a parameter is included on the DEFAULT/ card but no value is assigned, it is given the unchanged value shown in the "included-but-unspecified" column.

Of course, explicit value assignments (e.g., H=32) are heeded if they make sense. (By "making sense" we mean that logical

input units must have been previously and properly defined, and numerical values for Edition and Trim parameters must be in bounds.)

DELETE/ m,n

This is a command to delete cards m through n, inclusive. Specification of a single sequence number (e.g., DELETE/ m) deletes the one card. Input Hollerith or COSY card records are counted 1,2,3,... (base 10) for such sequencing purposes.

The deleted card(s) will be replaced by any Hollerith cards, if any, immediately following the DELETE/ control card. Replacement need not be one-to-one.

All deck revisions are made with DELETE/, INSERT/, and COVER/ control cards and with the Hollerith cards that accompany them. They must be in ascending order of sequence number (m and n) for each deck. They must immediately precede the DECK/ control card for the deck they are to update.

ENDCOSY/

This control card signals the termination of input to the COSY processor. Any non-standard output units referenced on the last DECK/ control card are rewound, then control is returned to OS-3. A file mark will have the same effect as an ENDCOSY/ control card if it is encountered on the COSY input unit.

FWSP/ lun,lun,...

This is a request to forward-space the one or more logical units. It is analogous to the OS-3 control-mode #FWSP command.

Examples: FWSP/ 5
 FWSP/ 5,6
 FWSP/ 5,6,13(4)

INSERT/ m

The Hollerith cards immediately following this control card are placed into the new deck following the input card image with sequence number m.

See DELETE/ for more details.

deckname POSITION/ lun

This is a command to find the indicated deck (cf. 'deckname') in the COSY library on the specified logical unit. Searching starts at the current position in that file. If the deck is not found before the end, the lun is rewound and searched from the beginning. Upon completion, the lun is positioned at the start of the deck, i.e., before the appropriate COSY/ card. If a log listing was requested in the COSY processor call, the COSY/ card from each deck passed will be displayed in the log.

If no deck name is given (i.e., 'deckname'=blanks), this command is interpreted as a request to search to the end of the COSY library on the designated logical unit. The file will be positioned after the final deck, before the second of the two file marks which typically terminate a COSY library.

RELEASE/ lun,lun,...

This is a request to release (i.e., throw away) the information in the one or more specified logical units. It is analogous to the OS-3 control-mode #RELEASE command.

REWIND/ lun,lun,...

This is a request to rewind the one or more designated logical units. It is analogous to the OS-3 control-mode #REWIND command.

SEFB/ lun,lun,...

This command causes each specified logical unit to be searched backward until a file mark is passed or until the beginning of the file is encountered. Each of the luns must have been previously defined. This COSY command is entirely analogous to the OS-3 #SEFB control-mode command.

Examples: SEFB/ 5,6,1
 SEFB/ 13(2),7
 SEFB/ 6,6

SEFF/ lun,lun,...

This COSY command is analogous to the OS-3 #SEFF control-mode command. Each indicated lun is searched forward until a file mark is passed or until the end of the file is encountered.

WFM/ lun,lun,...

This is a request to write a file mark on each of the specified logical units and as many times as indicated. This COSY command is analogous to the OS-3 #WFM control-mode command.

Examples: WFM/ 5,5
 WFM/ 5(2)
 WFM/ 6,7,8

FORMAT OF OS-3 COSY BINARY CARD

| <u>Column</u> | <u>Item</u> |
|---------------|--|
| 1 | 12, 11, 7, and 9 punches; if last card of deck, also a 3 punch. Rows 4-6 contain the high-order octal digit of a 5-digit card sequence number. |
| 2 | The four low-order octal digits of the 5-digit card sequence number. |
| 3-4 | 24-bit checksum. |
| 5-80 | 38 words of compressed symbolic information. |

Special character value assignments used to achieve compression:

| <u>Octal BCD Value</u> | <u>Special Meaning</u> |
|------------------------|------------------------------|
| 12 | End of Record |
| 16 | 2 blanks |
| 17 | 3 blanks |
| 35 | 4 blanks |
| 36 | 5 blanks |
| 37 | 6 blanks |
| 52xx | Special character indicator* |
| 55 | 7 blanks |
| 56 | 8 blanks |
| 57 | 9 blanks |
| 75 | End of Deck |
| 76xx | (xx+10) blanks |

* For example, 5212 indicates a colon, 5237 a semicolon.

STARTING A NEW COSY DECK

Recall that Hollerith source files can be created with the use of OS-3 EDIT facilities, and that the Editor COUT command automatically produces a COSY file. This is one way to initiate a COSY deck.

On the other hand, the following deck structure produces a COSY deck from punched Hollerith cards, plus a listing with sequence numbers:

```
#JOB,jobnumber,usernumber,SMITH
#LABEL,62/SMITH
#COSY
NEWNAME DECK/  C,L
(Hollerith card deck)
##
#LOGOFF
```

In the next example, several changes are made to an existing deck.

The COSY calling parameter specifies that a log listing will be made on logical unit 61.

In order, the changes made are:

- (1) The fortieth card is deleted,
- (2) Two other cards are inserted after the 71st, and
- (3) Cards 853 and 854 are replaced by a single different card.

The DECK/ card specifies Hollerith output to lun 50 and requests a listing of revisions. That listing follows, with deletions and insertions identified appropriately. The old COSY deck itself would immediately follow the DECK/ card, since in this case deck input is by default from lun 60. The COSY/ card is the first card of the COSY deck, and it is reproduced on the listing.

```

#COSY,LOG
      DELETE/    40
      INSERT/    71
BUFDRT  BSS      6
TODAY   BSS      1
      DELETE/   853,854
      INA      FUDGE
FM      DECK/    H=50,R
FM      COSY/    11
      ENTRY    RTNONE    05/25/70    1619
      00040    DELETED
BUFDRT  BSS      6    INSERTED
TODAY   BSS      1    INSERTED
      SHA      1    00853    DELETED
      INA      BUFNAM    00854    DELETED
      INA      FUDGE    INSERTED
      ENDCOSY/

```

Below is a sample of a log listing showing control cards and corrections processed during a COSY run. The revisions listing is also included, having been assigned to the same logical unit. Briefly, the processing sequence was as follows:

- (1) Input unit 10 is positioned to the COSY deck named COMPASS.
- (2) COSY decks are copied from unit 10 to unit 20 until deck PASSONE is reached. In fact, two decks (COMPASS and OVERLAY1) are copied.
- (3) Revisions for the next deck (PASSONE) are supplied.
- (4) The DECK/ control card for PASSONE calls for Hollerith output to logical unit 50 and a revision listing to the same logical unit as the log. The Hollerith output will incorporate the preceding deletions and insertions.
- (5) More COSY decks (PASSTWO and CRT) are copied from unit 10 to unit 20, up to deck PRELIB.
- (6) The ENDCOSY/ control card rewinds units 10 and 20 and returns control to the system.

An updated COSY library is now on unit 20. A probable next step is to call in the COMPASS Assembler to assemble the updated program on unit 50.

